AMENDED SPECIFICATION

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PATENT SPECIFICATION

923,252

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Dehydrated Potato

We, THE BORDEN COMPANY, a corporation organized under the laws of the State of New Jersey, United States of America, of 350 Madison Avenue, New York, State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a process for preparing cooked, dehydrated potato reconstitutable to give mashed potato that is non-sticky and of good texture.

Cooked, dehydrated potatoes have been made heretofore by forming in effect a mashed potato and incorporating into the wet mash various conventional components such as an antioxidant, preservative, and parting agent to improve separation of the material from rolls or the like during processing. The mash is then dried as in a thin layer on steam-heated rollers. The dried sheets so formed are broken into flakes and the product packaged for shipment.

While the product so made has merit, it has certain disadvantages that restrict consumer acceptance. Among these disadvantages are the formation of a gummy mass during reconstitution if stirred too vigorously with an electric mixer, sensitiveness of the mass upon reconstitution to small variations in the proportion of reconstituting liquid, doughiness or stickiness of the product that causes adherence of it to the beater and to the utensil in which the dried product is stirred during reconstitution, gradual stiffening up and development of a shiny appearance of the surface of the reconstituted product, or lack of the texture of the usual home mashed potato.

[*Price 4s. 6d*]

The present invention provides a process and product which eliminates these disadvantages or reduces them to such extent as greatly to increase acceptability of the product.

The present invention provides a process for preparing a potato product comprising cooked and disintegrated potatoes in dried particulate form and a texture improving and antisticking agent that is an edible and oxidation resistant surfactant that contains both hydrophobic and hydrophilic groups, the proportion of the said agent being 0.2 to 1.5 parts per 100 parts by weight of the dried potato wherein the texture-improving and anti-sticking agent is applied to the cooked potato at a stage subsequent to the drying of the particles thereof.

The present invention also provides in a process for preparing cooked, disintegrated, and then dried potato in particulate form reconstitutable by mixing with water to the form of mashed potato, the steps of applying to the cooked potato, at a stage subsequent to drying the particles thereof, a texture improving and anti-sticking agent that is a non-toxic, edible, and oxidation resistant surfactant that contains both hydrophilic and hydrophobic groups, the proportion of the said agent being 0.2 to 1.5 parts per 100 parts by weight of the dried potato.

The texture improving and antisticking agent is sometimes hereinafter referred to as the "improver".

In general, the process of the present invention may be carried out as follows. Cooked and disintegrated potato containing approximately its natural proportion of water and, if desired, the said conventional components is applied as a thin layer to a drying roller or drying

rollers and there dried. The resulting dried thin sheet is then cut or broken into particles, thin flakes being illustrative. In a subsequent step, the improver is introduced. In a preferred embodiment, the improver is usually glycerine monopalmitate (GMP), conveniently mixed with a hydrogenated vegetable fat, and it is sprayed upon the dried flakes.

The product so sprayed is then reconstitutable to mashed potato, for example at about 160°F. in a water and milk mix. The reconstituted material, when dropped on a plate, undergoes spreading and disintegration to about the extent that is normal for home mashed potatoes. A representative product showed 35 seconds required for penetration by a plunger in our standard consistency test. A product made comparably but with no addition of the improver subsequent to drying the potato was thinner, more sticky, required only 8 seconds for penetration by the plunger, and did not disintegrate but simply spread when dropped on the plate.

It is considered that the results are due in part at least to partial isolation of starch coming from ruptured cells resulting from processing and reconstituting. This isolation, in turn, may be explained by the orientation of the hydrophilic and hydrophobic groups of the GMP with the hydrophilic "head" in the potato and the hydrophobic "tail" of the molecule extending outwardly from the surface of the previously dried potato, so as to decrease the accessibility of the cells to water. Such orientation would decrease the accessibility to water which otherwise would cause pasting of the potato. Also the texture improving and antisticking agent may be considered to decrease the accessibility of the cells by incipient gelling with water in contact with the surface of the potato, on which interface the said agent should be somewhat concentrated.

If, on the other hand, the addition of the "improver" is made to the disintegrated potato before it is dried and the mixture then dried, the reconstituted potato resembles the product made without the addition. The desired action of the "improver" is eliminated by the drying step; the beneficial changes in the product so made do not appear after reconstitution.

The invention will now be further illustrated by way of Example with reference to the accompanying drawings in which

Fig. 1 shows an elevation of suitable equipment for applying the texture improving and antisticking agent to the dried flakes or other dried particles of potato and

Fig. 2 is an enlarged view, partly in section, of the spray nozzle applying the improver to the flakes.

The figures are in part diagrammatic. Equipment not shown in detail is conventional.

The mixture 10 of the texture improving and antisticking agent (usually a mixture of the said agent and a fat) is kept in melted condition in the steam jacketed container 12 with steam inlet 13 and outlet 14, the steam used being ordinarily at about atmospheric pressure.

The line 15 siphons the melted mixture to the adjustable metering valve 16 and then to the spray nozzle 18. This nozzle is provided with a steam jacket 19 with entrance 20 for the steam and exhaust 22 with gauge 23, the sprayed particles of the improver and fat spreading as shown at 24 and falling upon the dried potato flakes 26 delivered through hopper 28 to the upper reach of the conveyor belt 30 passing over the rollers 32 and 34. The flakes with the applied mixture of agent and fat then fall to a collector (not shown).

The spray nozzle shown in some detail in Fig. 2 is type 1/4 JBCJ of Spraying Systems Company. In addition to the inlet and outlet for the steam, which maintains the liquid 10 in heated condition, and for the said liquid itself, there is the inlet 36 for air, air duct 37 to the nozzle 40, and the control valve 38.

While this equipment is designed for use with relatively high air pressures such as 10—60 lbs/sq.in., we reduce the air pressure to a wholly abnormal level such as 0.2—0.5 lbs/sq.in. and up to 2 lbs/sq.in. By the use of such low air pressure, we avoid formation of a fine mist or fog of the sprayed material, avoid excessive cooling by the dispersing air, and cause the liquid 10 to fall in the form of droplets of substantial size upon the potato flakes without the droplets freezing in the passage from the nozzle to the flakes.

The fat serves, among other things, as a solvent for the texture improving agent and lowers the melting point thereof.

In a representative operation, the spray nozzle is adjusted to deliver 25—30 grams of the mixture of texture improving and antisticking agent and fat per minute. The nozzle is mounted with the delivery orifice 6 inches above the conveyor belt, the belt is 8 inches wide, and its speed to the right in the figures is about 1 foot per second. Approximately 5 pounds of the dried potato flakes in a layer 1—3 flakes thick pass under the spray per minute. The molten liquid 10, sprayed at the stated low air pressure, strikes the flakes while it is still in liquid condition. It then solidifies in 2 to 3 seconds on the average and is ready for packaging when delivered from the conveyor, at the right side of Fig. 1, after 5—6 seconds.

At the start of the operation the air pressure used is approximately 10 lbs/sq.in. with the control valve 16 completely open, to start the siphon effect. Then the air pressure is caused to drop by adjustment of the valves, to a level at which the liquid is broken up in the spray nozzle into coarse droplets but without causing any appreciable extraneous fog

and without freezing the droplets before they strike the potato flakes.

When water strikes the treated flakes, in the reconstituting operation, the water becomes quickly associated with the said agent before time elapses for objectionable action of water with the potato at the temperature of 160° to 170°F.

Various kinds of potatoes may be selected. We use to advantage those of medium to high solids content, as, for instance, those from Maine. New potatoes or those that are particularly high in water content are not recommended by us although benefited by our process.

As the texture improving and antisticking agent, we use a water-dispersible surfactant that is non-toxic and edible, has both hydrophobic and hydrophilic groups, and is resistant to oxidation to the extent of preventing development of rancidity of the agent as used on the dried potato. The agent can be a mono- or diester of a C_{12} to C_{20} monocarboxylic saturated aliphatic acid with glycerine and/or other non-toxic polyhydric alcohol with no more than 6 carbon atoms in the molecule, an alkylene oxide derivative of the said acid or ester, lecithin, or a mono-, di-, or triester of a C_1 to C_{12} sugar with a C_{12} to C_{20} saturated monocarboxylic fatty acid. Examples that meet the general requirements stated and illustrate the class of materials to be used are the following: Glycerine monopalmitate, monolaurate, and monostearate and corresponding monoglycerides of other C_{12} to C_{20} monocarboxylic saturated aliphatic acids, suitably in the condition of having been molecularly distilled and of content of monoglyceride, as distinguished from diglyceride, in the product of at least 60% by weight and preferably 80 to 100% by weight of the glycerine esters present; like partial esters, that is esters of the above-mentioned acids with polyhydric alcohols which esters contain free hydroxyl groups, such as mono- and diesters of the said acids with glycerine and/or other non-toxic polyhydric alcohols that contain not more than 6 carbon atoms in the molecule, examples being propylene glycol and sorbitol; MYRJ 45 which is a low melting polyoxyethylene derivative of a fat-forming higher fatty acid such as stearic acid, with 8 units of ethylene oxide to 1 of the acid; corresponding derivatives of other of said C_{12} to C_{20} acids such as lauric and palmitic; and Tween 65 which is polyoxyethylene sorbitan tristearate containing 3 to 20 units of ethylene oxide to the molecule (" Tween " is a Registered Trade Mark). All of these " improvers " require no admixed fat as supplied to the spray nozzle. Lecithin of good grade can also be used although this is less satisfactory in texture improvements than the glycerine monoesters. Other agents in accordance with the invention include partial esters, particularly the mono-, di-, and triesters, of any C_4 to C_{12} sugar such as sorbose, dextrose, levulose, sucrose, lactose and maltose with a C_{12} to C_{20} saturated monocarboxylic fatty acid. Finally, the agents may be edible monocarboxylic fatty acids of C_{12} to C_{20} chain length such as palmitic acid, stearic acid and oleic acid and alkali metal salts of such acids as potassium and sodium stearate and sodium palmitate.

Parting materials that may be incorporated in the wet potato mash may be any usual material that prevents sticking of wet starchy compositions to heated rolls. They may be the texture improving and antisticking agents described above. When used, however, in the mash before drying, these agents are not effective in giving our non-sticky, properly mealy reconstituted product.

Fats to be incorporated with the texture improving and antisticking agent, in those cases in which the introduction of a fat is necessary to lower the melting point to working temperature, are non-oxidising. Hydrogenated fats are particularly satisfactory. They avoid development of rancidity in the product on contact with air. Ordinarily we use a hydrogenated vegetable oil as, for instance, hydrogenated soyabean, corn, or cottonseed oil, an example being Primex B & C. Other fatty materials that may be used are the triglyceride of any C_{12} to C_{20} monocarboxylic fatty acid and, for best results, a C_{12} to C_{18} acid.

The antioxidant used to suppress the development of rancidity in any unsaturated fats present may be any antioxidant commonly used in food products for prevention of rancidity or oxidation of fats. Examples of such antioxidants are butylated hydroxyanisole, butylated hydroxytoluene, and propyl gallate and citric acid as synergistic material. These materials may be introduced separately but are suitably used in admixture with each other, as in the product Tenox 6. " Tenox " is a Registered Trade Mark.

Approved preservatives such as sodium sulphite and sodium bisulphite alone or mixed may be added and are suitably incorporated into the wet mash before drying.

As solvent for the texture improving and antisticking agent, there may be used, in place of part or all of the fat, a polyhydroxy compound of which propylene glycol is an example. Also glycerine may be used, for example in a mixture with the said glycol.

The proportion of the said agent used varies somewhat with the kind of potatoes processed and the particular degree of mealiness or antistickiness required in the finished product. Permissible proportions of the agent are 0.2 to 1.5 parts and for best results 0.2 to 1 part per 100 parts by weight of dried potato. When the proportion is less than the minimum amount stated, the effect in eliminating stickiness or increasing the mealiness of the reconstituted product is inadequate for most pur-

poses. When the proportion is much above 1%, then the taste is occasionally affected. The exact proportion varies with the particular agents selected, the conditions of reconstitution, and particularly the variety of potatoes used. We require less of the texture improving agent, within the ranges stated, for potatoes such as Idaho Russet Burbank that are relatively high in solids content.

When the solvent such as one of the fats stated or the mixture of the fat with propylene glycol is used, it is in the proportion of 10 to 100 parts per 100 parts of the texture improving and antisticking agent. Propylene glycol may be used in the proportion of 10 to 40 parts per 100 of the fat or alone in the amount of 5 to 30 parts per 100 of the said agent.

The parting material, preservative, antioxidants, and the seasoning materials, if any, may be incorporated into the wet mash, before drying, in kind and in amount which is conventional in this type of product, a preservative such as sodium sulphite or bisulphite or mixture thereof being used ordinarily in amount less than 0.1 part by weight per 100 of the dried potato.

The reconstituting liquid, such as water or a mixture of water and milk, in the proportions of 2 to 3 parts by weight of the former to 1 of the latter, is used ordinarily in the amount 4.5 to 6 parts by weight of the liquid to 1 of the dried potato material.

The test for consistency of the reconstituted product is made by dropping a standard plunger vertically from a 1 inch height on to a mass of the said product. For this test the plunger is the usual type of 15 ml. glass centrifuge tube having a tapered lower portion, terminating in a rounded narrow end which is downward in the test. The tube is weighted with mercury, to give a total weight of 57 grams, and closed. The time is noted for the plunger, under its own weight, to sink in the mass of reconstituted potato to the 6 ml. mark just above the level at which the tube becomes full width.

While the numerical values in the plunger penetration test vary from batch to batch because of variations in kind of potatoes used and other factors, we have found in all cases a slowing down in the rate of penetration of the plunger, showing increased mealiness or resistance to flow for a given proportion of reconstituting liquid used, when the improver is added to the cooked potato after the original mash has been dried. The same agent added to the mash before drying does not give the result.

In the following Examples and elsewhere herein, proportions and percentages are expressed as parts by weight.

In the Examples the apparatus illustrated in the accompanying drawings was used.

EXAMPLE 1.

Maine Katahdin potatoes of water content 17.5% to 20% were peeled as by pressure steam at 115 lbs./sq.in., de-eyed, washed, sliced, and cooked in water or in steam or both, all in conventional manner. Steam cooking, if used, was ordinarily with atmospheric pressure steam for 17 minutes. The potato slices so cooked were then disintegrated by passage through 0.4 inch holes such as those of an ordinary type of meat grinder from which the cutting knives had been moved. The resulting potato mash was then mixed with 0.075% to Tenox 6 antioxidant and 0.1% of GMP parting agent calculated on the dry weight of potato and with sodium sulphite (3 parts) and bisulphite (1 part) in an amount to provide 0.02% of SO_2 in the final dried product. The whole was then applied as a layer 0.005—0.01 inch thick over the exterior of a steam-heated drying roller. As the roller was rotated to the position at which the sheet had been dried, the dried sheet was removed by scrapers. At this stage it contained 3.5%—4% of water although proportions of water as high as 7% or so are considered permissible but not desirable. The dried sheet was then passed through breakers or cutters which formed it into small flakes about a half inch square, resembling somewhat ordinary soap flakes.

The dried potato flakes were treated with the texture improving and antisticking agent, by being sprayed therewith at the rate of 0.55% of the glycerine monopalmitate dissolved in an equal weight of hydrogenated cottonseed oil, this rate of addition corresponding to a total weight of GMP and fat of 1.1%—1.3% on the dry weight of the potato flakes.

The product, when reconstituted by being stirred at the rate of 1 part of the treated flakes to 5.5 parts of a mixture of 1.5 of boiling water to 0.5 of milk, was ready to serve after less than 1 minute's stirring into the heated liquid at 160°—170°F. The reconstituted material was mixed with a small proportion of butter and salt for seasoning. The product was not sticky in the vessel in which the reconstitution was effected or during eating. It had the desired mealy consistency and closely resembled the consistency, taste, and acceptability of home prepared mashed potatoes.

In the cutting or breaking of the dried potato sheet into flakes, heretofore mentioned, some free starch is liberated. Excessive breakage could result in a sticky unacceptable mashed potato. The addition of the texture improving and anti-sticking agent counteracts the deleterious effects of such breakage upon the texture of the reconstituted potato flakes to a noticeable extent.

In a modification of this Example, the combination of the cooking in water followed by the steam cooking was replaced by either the water cooking alone or the steam cooking alone, the time being adjusted to give a well-cooked disintegratable product at the time of the breaking down of the original structure.

EXAMPLE 2.

The procedure and composition of Example 1 were used except as noted below.

The potatoes used were Idaho Russet Burbank and the liquid sprayed on corresponded to a total of 0.8% of the weight of the dried flakes, the GMP being used in a mixture with equal parts by weight of hydrogenated cottonseed oil. When reconstituted the product was desirably short, dry, and fluffy, with a sinking time of 12 seconds in the standard plunger test.

In a modification of this example, the potatoes were made into granules of the cooked material by a conventional process comprising slicing the potatoes, boiling the slices, followed by dicing, mixing with water and sodium bisulphate, drying, granulating and further drying. About 0.5% of the said mixture of texture preserving agent and fat was sprayed upon the dried granular material. The reconstituted product was short, dry, and fluffy and the sinking time of the plunger in the standard test was 3 seconds as against a sinking time of approximately 0 seconds when none of the liquid had been sprayed upon the granules.

EXAMPLE 3.

In a modification of Example 1, the Tenox antioxidant (mixed butylated hydroxyanisole and hydroxytoluene, propyl gallate, and citric acid in propylene glycol solution) was mixed in the proportion of approximately 0.35 part of the Tenox for 100 parts of the mixed fat and texture improving and antisticking agent and the resulting three-component mixture was applied by means of the pneumatic spray nozzle as described. The procedure was otherwise as described.

EXAMPLE 4.

The procedure and composition of Example 1 were used except that the glycerine monopalmitate there used was replaced by lecithin in the proportion of 0.8% of the dry weight of the potato. The product obtained after reconstitution was satisfactory in the desired non-stickiness but not as short or mealy as products made with the glycerine monoesters.

EXAMPLE 5.

The procedure and composition of Example 1 were used except that the glycerine monopalmitate there used was replaced by sucrose dipalmitate in the proportion of 0.8% of the dry weight of the potato. The product after reconstitution was satisfactory.

EXAMPLE 6.

Dried flakes of the cooked and then disintegrated potatoes were made by the conventional process. The flakes were then reconstituted as described in the mixture of water and milk (1 part to 3 of water) at about 160°F. Into the reconstituted mashed potato so made there was then introduced and stirred 0.4% of the improver, i.e., the texture improving and antisticking agent, along with 0.4% of hydrogenated cottonseed oil. In this Example, the agent was glycerine monopalmitate. The product was acceptable from the standpoint of non-stickiness and mealiness.

It is essential that the improver be introduced subsequent to the time of drying the potato after the original disintegration. This avoids binding of the improver within particles of dried material or reaction of the improver with the potato in the hot wet mash or during the succeeding drying step.

EXAMPLE 7.

The stickiness caused by the boiling liquid can also be lowered by incorporating from 10 to 25 parts by weight of non-fat milk solids with every 100 parts by weight of the dried potato flakes.

80 Grams of the potato flake composition of Example 1 treated with the texture improving and antisticking agent was admixed with 13 grams of non-fat milk solids, preferably agglomerated, for example by the process of British Patent Specification No. 753,600, to make it more readily soluble in water. Two cups of boiling hot water were added to the mixture which was then stirred and beaten with a fork for 45 seconds. The resulting whipped potato had a less gelatinous and sticky texture than the same potato flakes to which 1½ cups of water and ½ cup of milk had been added at the boiling point and then beaten in a similar manner.

Adding the milk in the powdered form appears to inhibit a reaction between the milk and the potato which leads to stickiness and rubberiness, especially at elevated constitution temperatures. When the non-fat milk solids were added to the mash and dried with the potato flakes, they did not have the desirable action.

The procedure and composition of any one of Examples 1—5 can be used exactly as described with the exception of the following substitutions:

Any of the texture improving and antisticking agents disclosed herein or mixtures of them can be substituted on an equal weight basis for the agent used for the same purpose.

Any of the fats disclosed or mixtures of fat with propylene glycol can be substituted on an equal weight basis for the fat used.

The texture improving and antisticking agent can be replaced by an equal weight of MYRJ 45 or Tween 65 and the fat used with the replaced improver can be omitted.

Any of the preservatives and parting materials disclosed herein can be introduced in conventional amounts in the wet disintegrated potato before it is dried, and any one of the antioxidants can be supplied either before or after the drying step.

The temperature of reconstitution can be higher than the range stated, as up to the boiling point of water. At the higher temperature, there is some gelatinisation and development of stickiness, but to a smaller extent than when no improver is present.

The improver can be introduced in solid form, as by being dusted into the dried flakes.

We are aware of the Public Health (Preservatives &c in Food) Regulations 1925—1953 and, in so far as our invention relates to the manufacture for sale in the United Kingdom and/or to sale in the United Kingdom of foodstuffs preserved as described herein, we make no claim to use the invention contrary to law and, subject to the foregoing disclaimer . . .

WHAT WE CLAIM IS:—

1. A process for preparing a potato product comprising cooked and disintegrated potatoes in dried particulate form and a texture improving and antisticking agent that is an edible and oxidation-resistant surfactant that contains both hydrophobic and hydrophilic groups, the proportion of the said agent being 0.2 to 1.5 parts per 100 parts by weight of the dried potato wherein the texture-improving and anti-sticking agent is applied to the cooked potato at a stage subsequent to the drying of the particles thereof.

2. A process as claimed in claim 1, wherein the agent is a mono- or diester of a C_{12} to C_{20} monocarboxylic saturated aliphatic acid with glycerine and/or other non-toxic polyhydric alcohol with no more than 6 carbon atoms in the molecule, an alkylene oxide derivative of the said acid or ester, lecithin, or a mono-, di-, or triester of a C_1 to C_{12} sugar with a C_{12} to C_{20} saturated monocarboxylic fatty acid.

3. A process as claimed in claim 2 wherein the agent is glycerine monopalmitate.

4. A process according to claim 1 wherein the agent is a C_{12} to C_{20} monocarboxylic saturated aliphatic acid or an alkali metal salt of a C_{12} to C_{20} monocarboxylic saturated aliphatic acid.

5. A process according to claim 1 wherein the agent is applied to the dried potato flakes in the form of a molten mixture of the agent and a glyceride fat that is stable in air.

6. A process according to claim 1 wherein the agent is applied to the dried flakes by being sprayed thereon in liquid condition.

7. A process according to claim 1 wherein the agent is applied hot in propylene glycol solution in the proportion of 5 to 30 parts of propylene glycol per 100 of the agent.

8. A process according to claim 1 wherein 10 to 25 parts by weight of non-fat milk solids per 100 parts by weight of dried potato are added to the agent-treated dried potato.

9. A process as claimed in claim 1 substantially as described with reference to any one of Examples 1 to 6.

10. A process as claimed in claim 1 substantially as described with reference to Example 7.

11. A potato product when prepared by a process as claimed in any of the preceding claims.

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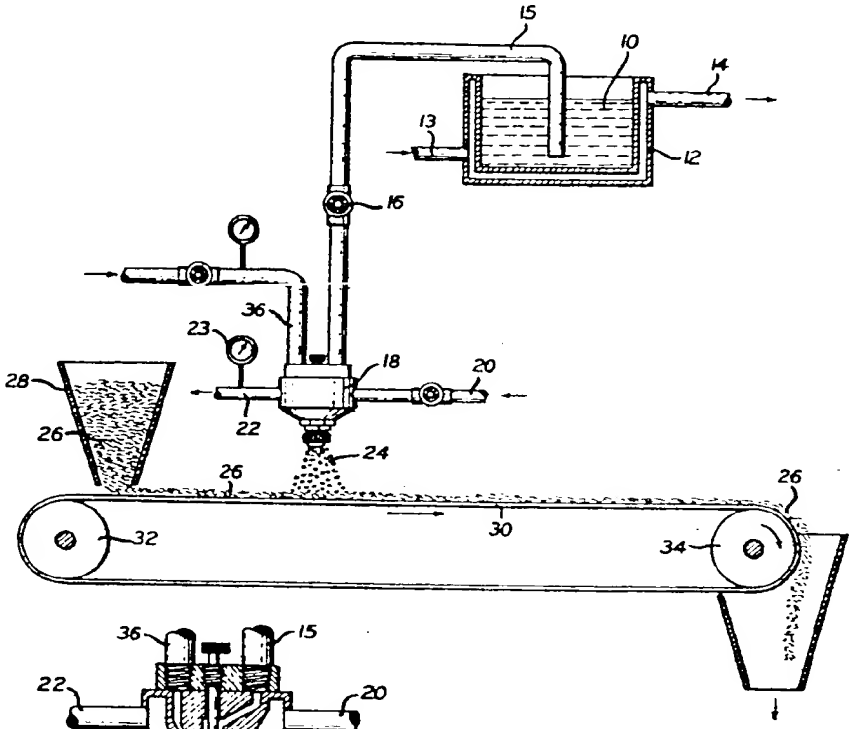
1 SHEET

AMENDED SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale

FIG. 1.



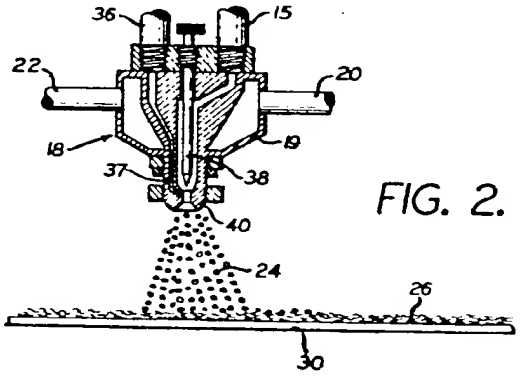


FIG. 2.